Technology Opportunity

The Series Connected Boost Regulator

The National Aeronautics and Space Administration (NASA) seeks to transfer the NASA-developed Series Connected Boost Regulator (SCBR) technology. The Series Connected Boost Regulator is simply a unique regulating configuration which connects the input voltage of any transformer isolated DC/DC converter in series with the output voltage of the converter producing a regulated and boosted supply voltage.

Potential Commercial Uses

- Solar Array Output Regulator
- Solar Array Battery Charger
- Battery Output Voltage Booster
- Thermionic Diode Output Regulator
- DC Voltage Line Booster

Benefits

- Very High Efficiency (93% - 98%)
- High Power Density (1,000 + W/kg)
- Extended Fault Tolerance Capabilities
- Easily Adapted to Positive Ground Systems
- Inexpensive to design and build
- Makes use of relatively inexpensive commercially available DC/DC converters

The Technology

The Series Connected Boost Regulator (SCBR) technology was developed at the NASA Glenn Research Center in the Power and On-Board Propulsion Division. The current trend in satellite design to develop small, reliable, and inexpensive spacecraft has greatly increased the need for a modular power management and distribution system (PMAD). This latest trend will help transition the aerospace industry towards an assembly line approach to building spacecraft. A proposed modular system is based on the innovative DC voltage boost converter of the SCBR. The SCBR is not a new DC/DC converter topology. Instead, it is a unique interconnect topology which makes novel use of an isolating DC/DC converter. The SCBR is based on the principle of biasing an isolated voltage source on top of another source.

The basic SCBR technology is shown in Figures 1-3. The two voltage sources in Figure 1 add together to provide 28Vdc to a 2.8 Ω load. The load current, I=10 A, is the same in each source since they are connected in series. The DC/DC converter input current can be calculated as 4.7 A, using the output power and efficiency of the DC/DC converter.

Since the DC/DC converter is isolated, we can use a single 20 Vdc power supply to bias the voltage across the load and power the DC/DC converter, as shown in Figure 2.

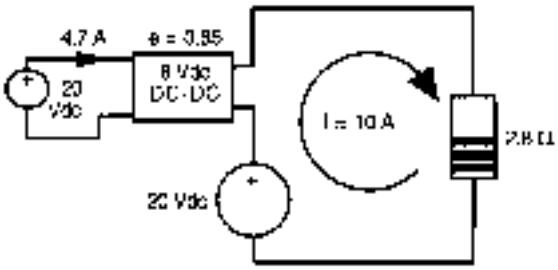

Figure 1.—Isolated DC/DC converters in series.

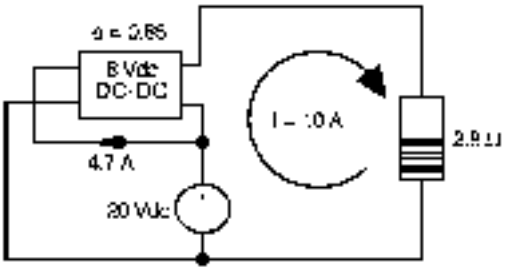

Figure 2.—Using a single 20 Vdc supply.

The circuit has been redrawn in Figures 3 to show the single power supply. Note that all circuit parameters remain the same. The result is that a DC-DC converter which is rated for 80 W (8 Vdc @ 10 A) is able to process and regulate 280 W, an increase of 350%. Also, the 85% efficient DC-DC converter still has losses of about 14 W, which now results in an SCBR efficiency of 95.2%. This "series connection" can be added to any isolated DC-DC converter to greatly increase the efficiency and power density of a power regulator.

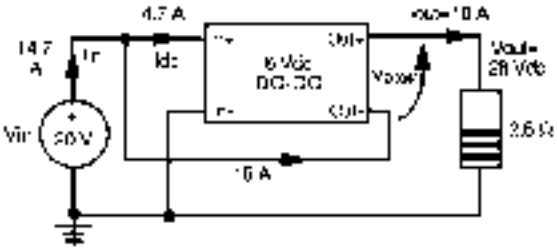

Figure 3.—Series Connected Boost Regulator (SCBR).

Options for Commercialization

The NASA Glenn Research Center believes the Series Connected Boost Regulator (SCBR) described herein can be manufactured and/or added to existing products from various manufacturers. NASA has been granted a patent for the SCBR; licensing arrangements are available. NASA is actively seeking partnership with industry for all applications.

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Key Words

Voltage Converter (DC to DC)
Power Converters
Voltage Regulator

References

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